Funtionalized oxide nanosheets : synthesis, characterization and non-electrostatic reassembly

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Since the discovery of the outstanding properties of graphene,[1] research on all kinds of nanosheets have increased considerably.[2] Applications of such nanosheets can be found in catalysis, magnetism, dielectrics, or batteries and capacitors.[3–5] In our laboratory we have been interested for several years in the synthesis and characterization of lamellar hybrid materials (oxides or hydroxides), essentially for their magnetic, optical or electrochemical properties.[6–8] Recently, we have developed new synthetic strategies, using micro-wave activation,[9] or *in situ* syntheses.[10–12] During these studies, we have obtained promising results on the microwave-assisted exfoliation of lamellar perovskites, known for their ferroelectric properties. This approach could allow to obtain easily and rapidly nanosheets, possibly already functionalized for a peculiar property (luminescence or magnetism for instance).

The proposed Ph-D project will consist in two principal aspects:

-study and optimization of the reaction conditions for the exfoliation of lamellar oxides using microwave activation: ultrasounds, role of the solvent… Influence of the functionalization of the interlamellar space on the exfoliation process and on the stability of the suspensions obtained. Optimization of the exfoliation yield and of the stability of the suspensions of nanosheets. Measurement and optimization of the size of the nanosheets (TEM, AFM, XRD, SAXS, DLS,…)

-Processing of the nanosheets: thin films, sequential deposition, flocculation. This aspect of the work will essentially deal with the study of the possibilities to reassemble different functionalized nanosheets using non-electrostatic interactions, which could allow to overcome some of the drawbacks of the purely electrostatic reassembly processes described to date (Fig. 1).

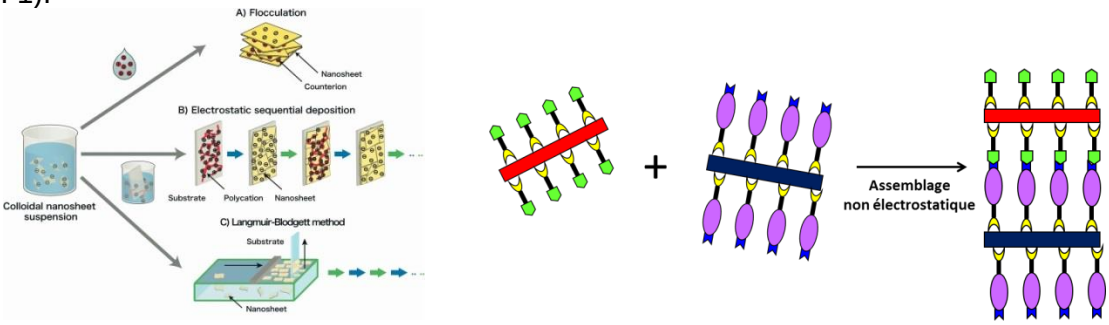

Figure 1. *Schematic view of varius processes for the reassembly of nanosheets (left : electrostatic,[4] right : non-electrostatic)*

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